X2000

ADVANCED DEEP SPACE SYSTEM DEVELOPMENT

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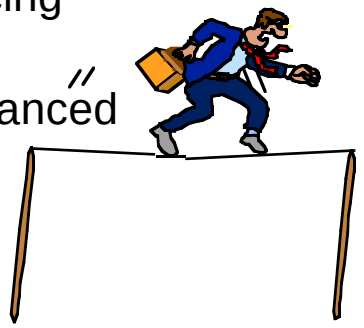
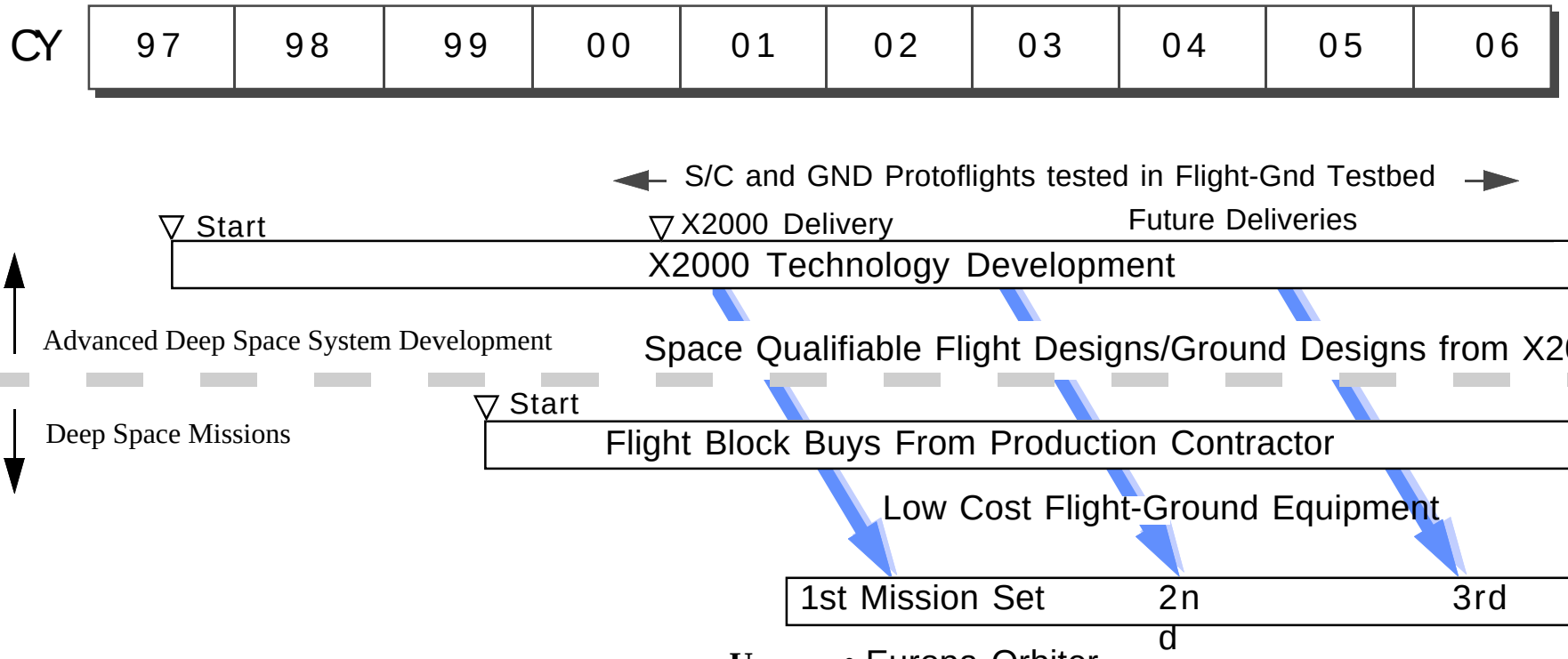
ADVANCED DEEP SPACE SYSTEM DEVELOPMENT (X2000) Is:

- Delivering tested, space qualifiable protoflight S/C - GND equipment representing dramatic technology breakthroughs
- Focused on development of S/C microelectronics -- towards " S/C on a Chip"
  - Driven by system architecture in turn driven by Science
  - Teamed with TMOD to develop a GND-S/C System Architecture
- Addressing all S/C technologies: advance power, propulsion, structures, etc.
- Not an Outer Planet pre-project, but uses rigorous project like performance tracking and control processes
  - Deliverables on schedule within a cost cap
- Primarily a JPL in-house task, but must be aware of: leverage, leap over, team with other NASA and Government Agencies Universities and Industry in Technology Dev
- Must walk a fine line between researched and development and servicing missions
- Must be aware of and assess feasibility, value, flight intro time of advanced Technologies:
  - Inflatable Structures
  - Multi-functional Structures
  - Optical Communications
  - Optical, Genetic, Neural Computing
  - Autonomous S/C-GND Operations
  - Solar Electric, Adv Chemical, Anti Matter Propulsion
  - Etc., etc., etc.,



TMOD = Telecommunications and Mission Operations Directorate GND = Ground Networks Division S/C = Spacecraft

Flow of Advanced Deep Space System Development Deliveries



Users:
- Europa Orbiter
- Pluto-Kuiper Express
- Solar Probe
- Champollion
- Mars Sample Return, Rendezvous, and Comm Orbiter Vehicles

Potential Users:
- DS-3, SIM, Other Mars Program
- Comet Nucleus Sample Return
- Possible SEC, Discovery Mission, other ...

Advanced Deep Space System Development Delivery

- Protoflight Micro-electronics include:
  - X-Band communications
  - Optional optical communications -- possible
  - Computer and memory
  - I/O to science/engineering sensors/instruments
  - Low voltage power switching
  - RAD hardening
  - Proof of Space Qualification, steps needed to accomplish Flight Acceptance testing

- Flight and GND S/W with W.S. include
  - Flight operating system
  - Generic cruise auto NAV and 3-axis attitude control S/W
  - Other generic autonomous S/C monitoring and control S/W
  - Generic flight/GND science data processing S/W
  - Generic GND Command, telemetry processing and display S/W and H/W
  - In addition, RF and flight-GND computer operations compatibility has been established between the micro-electronics and matched GDS

- Other: Components of micro-electronics, structures, propulsion, etc.

GND = Ground Networks Division W.S. = Work Station GDS = Ground Data System

- ADVANCED DEEP SPACE SYSTEM DEVELOPMENT (X2000), is comprised of the New Millennium Augmentation Budget Line Items:
  - Outer Planet Technology
  - Center Integrated Space Microsystem
  - Advanced RTG (called RPS)

FY98	99	00	01	MIL$
25	25	50	50	→
10	15	15	15	
10	10	10	10	
45	50	75	75	

Bottom Line

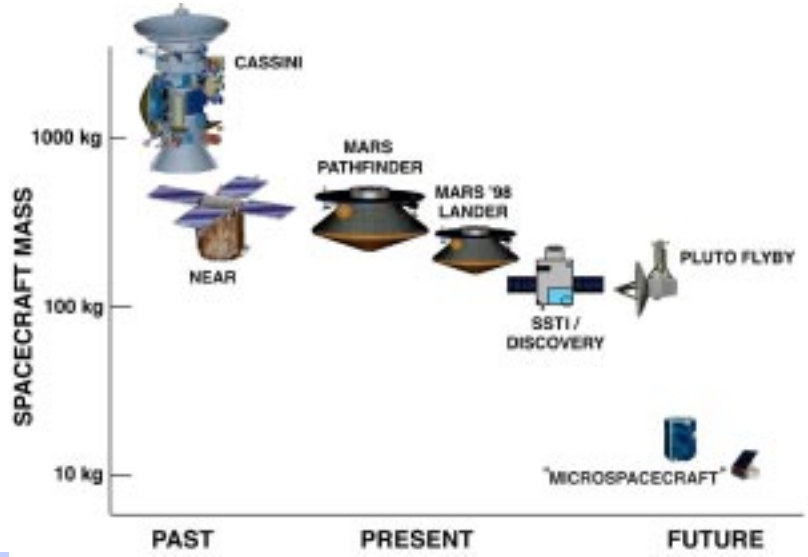
Dramatic breakthroughs

Enables many low cost missions

System architecture driven by science

Delivery Micro-electronics first

Delivery Micro-S/C next



RTG = Radioisotope Thermal Generator RPS = Radioisotope Power Source S/C = Spacecraft

Deliveries

	X2000	X2002	X2004
Target S/C Power	100W	50W	25W
Target S/C Mass	XXkg	XXkg	XXkg

- Protoflight S/C Micro-electronics
  - Computer and memory
    - Neural Network
    - Digital Signal Processor
  - nsor/Instrument I/O
  - Low Temperature Ops
  - Power Switching
  - X and Ka Band Comm
  - Optional Comm -- Possible
  - Scaleable, modular long life
  - RAD Hardened Designs and Parts

-Cost approx. 60 mil$

-Est of recurring less than 10 mil$

S/C and GND S/W with W.S:

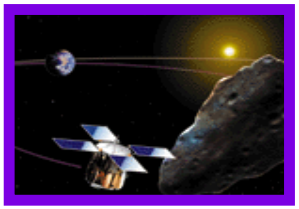
  - S/C Operating System
  - Generic auto NAV, 3-Axis A/C
  - Generic S/C-GND autonomy
  - Generic S/C-GND science data processing
  - Generic GND CMD/TLM processing/ display
- EM RPS and Solar options --if possible
- Other: Micro-electronic components, structures, propulsion, etc.

- Pick up where last delivery left off
- Options/possibilities
  - Direct deliveries to high-impact, long lived penatrators on to Aerobots
  - High-temp electronics
  - Holographic memory
  - Optical processing
  - Genetic, quantum computing

NOTE: RF and S/C-GND computer capability will be established by X2000 teamed with TMOD. Project arrive at multi-mission Ops W.S. with their TLM and CMD lists ready to train.

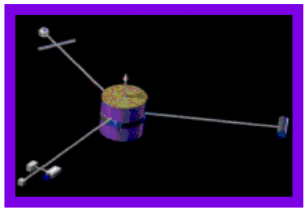
GND = Ground S/C = Spacecraft W.S. = Work Station S/W = Software A/C = Attitude Control CMD = Command Ops = Operations TLM = Telemetry

SOLAR SYSTEM EXPLORATION

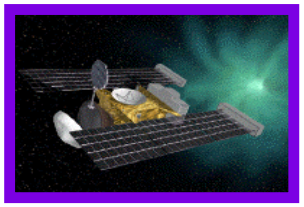


NEAR

MARS PATHFINDER



LUNAR PROSPECTOR



STARDUST

MUSES-CN

COMET SAMPLE RETURN

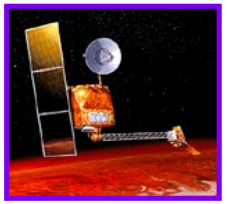
DS-1

DS-2

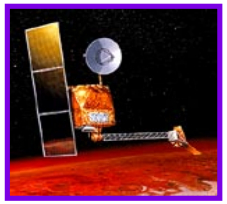
DS-3

CHAMPOLLION DS-4

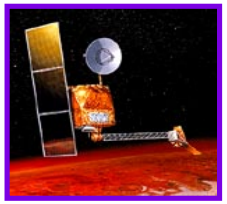
MGS



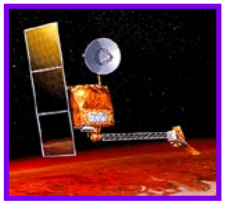
MARS '98 ORBITER



MARS '01 ORBITER



MARS '03 ORBITER

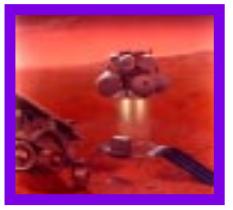


MARS '05 ORBITER

MARS '98 LANDER

MARS '01 LANDER/ROVER

MARS '03 LANDER/ROVER



ASCENT VEHICLE

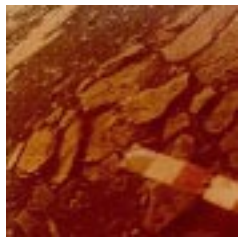
SOLAR SYSTEM EXPLORATION (con't)

EUROPA ORBITER

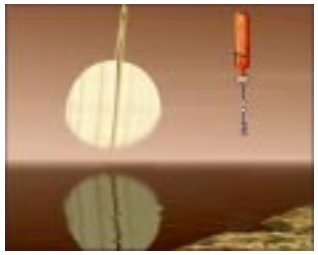
PLUTO-KUIPER EXPRESS

SOLAR PROBE

MERCURY OBITER

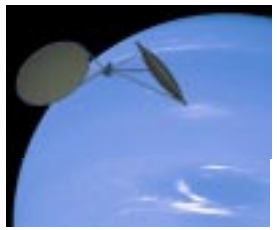


VENUS LANDER

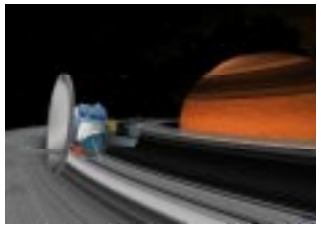


TITAN BIOLOGIC EXPLORER

OUTER PLANET MULTI-PROBES



NEPTUNE ORBITER



SATURN RING OBSERVER

IO VOLCANIC OBSERVER